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ABSTRACT

Using data from the older men's file of the National Longitudinal Surveys, two issues related to the labor market implications of dual economy theory were examined: variations in rates of pay among economic sectors (competitive, monopoly, and public) and variation in relative opportunities for blacks across sectors. The primary analytical problem was to decompose the difference in the mean level of pay in any two sectors into the following components: human capital composition, unionization, occupational skill requirements, and a residual. Analagous decompositions were made for racial (white/black) differences in pay. The results of the decomposition suggest that the primary factors producing a monopoly sector pay premium are (1) a greater ability and willingness to pay high wages due to greater economies of scale, market and political power, and a greater interest in developing a stable work force and (2) higher levels of unionization. In contrast to several previous studies, the relative disadvantages of black men were found to be somewhat greater in the competitive sector than in the monopoly sector. A significant portion of the disadvantage is due to the allocation of blacks, relative to whites with similar characteristics, to jobs requiring less skill. (YLB)

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# Pay Premiums for Economic Sector and Race: A Decomposition

by

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While conducting this analysis, I profited greatly from several discussions with Ron D'Amico. In addition, Randy Hodson, Bob Kaufman, Paul Schervish, Herb Parnes, Steve Hills, and Russ Rumberger provided valuable comments on an earlier draft. I would also like to thank Rufus Milsted for his excellent programming assistance. This report was prepared under a contract with the Employment and Training Administration, U.S. Department of Labor, under the authority of the Comprehensive Employment and Training Act. Researchers undertaking such projects under Government sponsorship are encouraged to express their own judgments. Interpretations or viewpoints contained in this document do not necessarily represent the official position or policy of the Department of Labor. An earlier version of this paper was presented at the American Sociological Association meeting in Boston in August, 1979.

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ABSTRACT

This paper examines two issues concerning a dual economy theory of labor markets. Using data from the older men's file of the National Longitudinal Surveys, I first investigate the degree to which differences in rates of pay among economic sectors (competitive, monopoly, public) are accounted for by sector differences in (1) human capital composition, (2) unionization, (3) occupational skill requirements, and (4) other factors producing an ability and willingness to pay high wages. The results of this decomposition suggests that the greater ability and willingness to pay high wages and the higher levels of unionization are the primary factors producing a monopoly sector pay premium. Second, I examine how racial differences in pay vary across sector and perform an analogous decomposition of these differences. In contrast to several previous studies, the relative disadvantages of black men were found to be somewhat greater in the competitive sector than in the monopoly sector.

## Introduction

In recent years, an increasing number of social scientists have investigated the ways in which the social organization of production affects the level of labor market rewards attained by employees. A considerable amount of this research has been conducted within a dual economy theoretical framework. This theory postulates that it is important to divide firms or industries in the economy into two sectors according to factors such as economies of scale, capital intensity, profitability, unionization, market power, and political power.[1] Within this framework, the monopoly sector is defined as consisting of firms with high levels of these factors and the competitive sector as consisting of firms with low levels. A basic tenet of this theory is that these differences produce fundamental differences in the processes by which people are matched to jobs. The labor market processes in the competitive sector can be more or less described by some of the principles of neoclassical economics. That is, there is a relatively free market with a price clearing mechanism by which individuals rent their labor to employers. The rate of pay for various forms of labor is viewed as being determined largely by supply and demand considerations. In contrast, the labor market processes in the monopoly sector are determined largely by administrative rules and collective bargaining agreements, and thus are somewhat insulated from short run competitive market factors (Edwards, 1975, 1979; Doeringer and Piore, 1971).

Clearly, dual economy theory constitutes an oversimplification of reality by focusing on a dichotomization of the economy. However, it is a potentially powerful analytical framework since several important hypotheses concerning differential access to labor market rewards follow from this parsimonious partitioning of the economy. For example, it has been hypothesized that (1) there is an economic payoff to working in the monopoly sector (Beck, Horan, and Tolbert, 1978; D'Amico, 1978; Hodson, 1978); (2) the relative opportunities of women and blacks are lower in the monopoly sector (Beck, Horan, and Tolbert, 1978a, 1978b; D'Amico, 1978); (3) the forms of unemployment vary across sector (Shervish, 1978); and (4) economic rewards accrue to jobs rather than to individuals to a greater degree in the monopoly sector (D'Amico, 1978). However, much work needs to be done in testing such hypotheses, as well as deriving new ones, before the utility of this framework can be fully assessed.

This paper examines several issues related to the labor market implications of dual economy theory. Specifically, I examine the size of the economic premium to being employed in the monopoly sector vis-a-vis the competitive sector. Moreover, I investigate the degree to which this premium is accounted for by sectoral differences in the degree and type of unionization and the skill levels of occupations. Of particular interest will be an examination of how the relative opportunities of blacks vary across sectors. Although the primary focus will be on the competitive and the monopoly sectors, I will also investigate the implications of being in the public sector. By examining these issues, it is hoped that we can

(1) improve our understanding of the labor market processes which affect older men, and (2) criticize and improve aspects of dual economy theory by subjecting particular interpretations of it to empirical validation.

Some Labor Market Implications of a Dual Economy

One of the most important labor market implications of a dual economy is the existence of an economic benefit to being employed in the monopoly sector. That is, even after controlling for a variety of individual characteristics, workers in the monopoly sector earn more than their counterparts in the competitive sector (Beck, Horan, and Tolbert, 1978a; D'Amico, 1978; Hodson, 1978). As discussed by D'Amico (1978) and others, there are a number of possible explanations for the economic premium for monopoly sector location. We group these explanations into three categories. The first explanation is that the greater degree of unionization in the monopoly sector provides workers in that sector with greater bargaining power in their negotiations with employers over pay and other rewards.

The second explanation is based on the observation that the occupational distributions differ in the two sectors. More specifically, it is expected that, on average, the jobs in the monopoly sector require greater levels of skill than those in the competitive sector. To the extent that this is true, and to the extent that monopoly sector employers fill these jobs by recruiting individuals with higher levels of human capital, then this is not part of a premium to monopoly sector employment but a reflection of differences in the characteristics of individuals in the monopoly and competitive sectors. However, to the extent that monopoly sector employers fill these jobs by hiring the same sort of workers as competitive sector

employers do, and then allocate them to more highly skilled jobs, then this would constitute part of the monopoly sector premium. Such differential allocation is expected because monopoly sector firms tend to be more capital intensive and tend to plan further into the future. Consequently, they are likely to be more interested in developing a stable work force, and thus, are likely to make greater investments in the skill development of their workers.

The third set of explanations has to do with reasons why monopoly sector employers would pay more than competitive sector employers to workers in jobs requiring the same degree of skill. Due to greater scale efficiencies, product market power, and political power, monopoly sector firms are better able to pay high wages. In addition, because of their greater desire for a stable work force and their interest in creating ties between workers and their jobs, they also have greater incentives to pay high wages.

Unfortunately, almost no empirical work has been done to assess the relative importance of these explanations of the monopoly sector premium. This paper constitutes an initial effort in this direction.

Although blacks are disadvantaged relative to whites in all sectors, there is disagreement as to whether the relative black disadvantages are different in the monopoly and competitive sector. Until very recently, the general consensus among those addressing this issue was that the degree of racial discrimination was greater in monopolistic than in competitive industries. This generalization holds whether the analysis was conducted within a neoclassical or a dual economy framework (Becker, 1971; Shepherd, 1970; Comanor, 1973; Haessel and Palmer, 1978; Beck, Horan, and Tolbert,

1978b; D'Amico, 1978). However, recent empirical work by Kaufman and Daymont (1978), Daymont (1979), and Johnson (1979) supports the conclusion that, all things considered, the level of discrimination is similar in the two sectors. On a conceptual level, arguments have been made to explain both sets of findings.

According to neoclassical economic theory, competitive markets operate such that inefficient firms will eventually be driven out of business. By definition, a discriminating firm is inefficient in that it is paying a white more than the wage at which it could hire an equally productive black. Hence the theory predicts that discriminating firms will be at a competitive disadvantage and will eventually be driven out of business by firms that do pay whites and blacks according to their relative productivity (Becker, 1971). However, firms with monopoly power are immune to these competitive pressures not to discriminate. Thus to the extent that discrimination exists, it is expected to exist primarily in monopolistic rather than competitive industries (Becker, 1971; Shepherd, 1970; Haessel and Palmer, 1978).

However, there are several reasons why this hypothesis may not be valid (Kaufman and Daymont, 1979). For example, the rationale behind this hypothesis is based on the assumption that the economy is in equilibrium while the American economy is at continual and changing disequilibria. Thus, one might question the degree to which competitive markets operate such that firms that are not efficient purchasers of labor (e.g., discriminating firms) are actually driven out of business. In addition, the logic of the neoclassical argument does not imply that immunity from competitive pressures will necessarily lead to greater discrimination; it implies only that firms with such immunity have more latitude to discriminate. Thus, the relative

incentives of competitive and monopolistic industries to discriminate or not to discriminate must be considered. Concerning these incentives, we suspect that in recent years monopolistic firms may have had more incentives not to discriminate than competitive firms. Because of their high degree of market power, and because they tend to be large, monopolistic firms have been more visible to the government and to the public at large. This visibility, coupled with an antidiscriminatory public policy, provided such firms with an incentive not to discriminate. For example, both the Equal Employment Opportunity Commission and the Office of Federal Contract Compliance were more likely to scrutinize the employment practices of large than small firms(Burman, 1973; Selznick, 1969).

Proponents of dual economy theory have also concluded that the level of discrimination will be greater in the monopoly sector than in the competitive sector (e.g., Beck, Horan, and Tolbert, 1978; D'Amico, 1978). Two lines of reasoning that are sometimes alluded to are a statistical discrimination argument and a conspiracy argument.[2]

Concerning statistical discrimination, it is believed that employers may underestimate the abilities of blacks, or may have less reliable information concerning their abilities, and therefore allocate blacks to less desirable jobs. Beck, Horan, and Tolbert (1978b) seem to argue that this form of discrimination is more pronounced in the monopoly sector. On the other hand, a consideration of sector differences in bureaucracy may lead to the hypothesis that the statistical discrimination argument is as important or even more important in the competitive sector. That is, since employment processes are less formal and more arbitrary in the

competitive sector, the use of race as an indicator of productivity may be greater in this sector than in the monopoly sector.

It is also argued that employers promote racism within the working class to create intra-working-class cleavages and keep them from developing a collective consciousness and organizing as a united group (Gordon, 1972). Such strategies for worker control may be more important in the monopoly sector for two reasons. First, as indicated above, a stable work force is more important to employers in the monopoly sector. Second, monopolistic employers have a greater ability to pay for such racism because of their higher profit margins. Interestingly, this second point brings us back to the primary argument of neoclassical theory: competitive sector employers do not discriminate as much as their monopoly sector counterparts because they cannot afford to.

Analytical Strategy

The primary analytical problem is to decompose the difference in the mean level of the rate of pay in any two sectors into the following components:

(1) Human capital composition. The amount of the sector difference in pay attributable to sector differences in the levels of several human capital (and location of residence) factors;

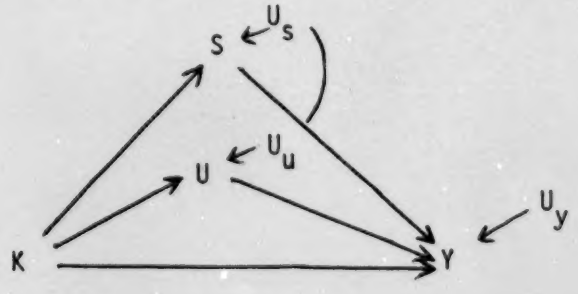
(2) Occupational skill requirements composition. The amount of the sector difference in pay attributable to sector differences in the way that men (with similar levels of human capital) are allocated to occupations with different skill requirements;

(3) Union composition. The amount of the sector difference in pay attributable to sector differences in the degree and type of unionization (among men with similar levels of human capital);

(4) A Residual. The amount of the sector difference in pay not attributable to the factors included in the model.

Analogous decompositions were made for racial (white-black) differences in pay. As implied by their definition, these components are conceptualized and are calculated in the context of a (block) recursive model for each of the 6 combinations of sector (competitive, monopoly, public) and race (white, black). As illustrated in Figure 1, human capital factors (K) affect the level of occupational skill requirements (S) and unionization (U). In addition, each of these sets of factors has a direct effect on hourly earnings (Y) (converted to log 1976 dollars). In this model, the association between occupational skill requirements and unionization not accounted for by human capital factors is left unanalyzed.[3]

Figure 1 Model of Earnings Attainment



More specifically, for each combination of sector and race, we posit the following model,

$$Y = a + \sum_i b_i K_i + \sum_j c_j S_j + \sum_k d_k U_k + u_y \quad (1)$$

$$S_j = e_j + \sum_i f_{ij} K_i + u_{sj} \quad (2)$$

$$U_k = g_k + \sum_i h_{ik} K_i + u_{uk} \quad (3)$$

with the following reduced form,

$$Y = r + \sum_i t_i K_i + v_y \quad (4)$$

where Y, K, S, and U are defined above and where a, b, c, d, f, g, h, are parameters to be estimated and u and v are residual terms. The variables in K constitute a fairly standard set of human capital factors and other control variables.[4]

Care must be taken in choosing an indicator of occupational skill requirements. Recall that the major purpose of including occupational skill requirements is to assess the degree to which the sectoral (racial) pay differences are due to sectoral (racial) differences in the allocation of men with similar individual characteristics to jobs with different skill requirements. Thus, I need an indicator of occupational skill requirements that is a measure of the job and not the incumbent of the job. At the same time I need an indicators that measures the activities of the job and does not constitute a direct measure of the rewards accruing to the job. In light of these considerations, the General Educational Development (GED) and the Specific Vocational Preparation (SVP), measured in years of

training time, from the Dictionary of Occupational Titles (DOT) were used as indicators of occupational skill requirements. These measures were used because they are specifically designed to be an estimate of the education level and the length of vocational preparation needed to perform adequately in an occupation (Fine, 1968; U.S. Employment Service, 1965).[5]

The degree of unionization, actually collective bargaining coverage, was measured at both the individual and industry level. At the individual level, three mutually exclusive dummy variables were included indicating whether or not the pay of the respondent was set by a collective bargaining agreement between the employer and an industrial type union (CBIND), a craft type union (CBCFT), or an "other" type union (CBOTH).[6] It is expected that unionization measured at the individual level will have a positive impact on pay. Unionization may also affect the pay of some individuals not directly covered by a collective bargaining agreement. This will be the case if, for example, the nonunionized firms in an industry pay a wage about equal to that in the unionized firms in order to combat union organizing efforts. To the extent that this occurs, there will be a payoff to being in a highly unionized industry even if the individual is not directly covered by a collective bargaining agreement. To allow this indirect effect of unionization, we included a variable defined as the proportion of all workers in the industry (measured at the 3-digit census code level of aggregation) that were covered by a collective bargaining agreement (% union) (Freeman and Medoff, 1979).

Sector was coded as public if the individual was employed by a federal, state, or local government at the time of the interview. Among private sector employees, sector was coded as competitive or monopoly according to Hodson's (1979) classification scheme for industries.[7] According to this scheme, an industry was assigned to the monopoly sector if (1) the average size of capital of firms in the industry tended to be large, and (2) if the industrial product market tended to be dominated by a few large firms. Otherwise an industry was assigned to the competitive sector (see Appendix B for the sector assignment of each industry).

The data used in this analysis were drawn from the older men sample (men aged 50-64 in 1971) of the National Longitudinal Surveys (NLS) (for a more complete description of these data, see Center for Human Resource Research, 1979). The basic sample consisted of all black and white men who had been a wage or salaried worker within 6 months prior to the interview in any of the years 1969, 1971, or 1976 for which certain other criteria were met.[8] For each individual, an observation was included for any of the three years in which the criteria were met. Thus the data file consists of 1, 2, or 3 observations for each individual. By pooling the three cross sections we are able to increase the precision with which we can estimate the parameters of our model. Ordinary least squares (OLS) was used to estimate the model since it provides unbiased estimates of the parameters. Moreover, even though OLS is not maximally efficient, previous experience suggests that there are only small differences in the parameters estimated by OLS and a more efficient error components

GLS procedure (see also Maddala and Mount, 1973). However, OLS gives biased estimates of the standard errors of the parameters. Therefore the standard errors are not presented (Maddala, 1971).

A regression standardization approach (Duncan, 1969; Winsborough and Dickenson, 1969; Iams and Thornton, 1975) was used to decompose the sector (or race) difference in the mean of log hourly earnings into the components listed in the beginning of this section. See Appendix A for the algebra of this decomposition. There are perhaps two aspects of this decomposition that should be noted here. First, the human capital composition component represents a total effect of sector (race) differences in human capital. That is,this component includes the indirect effect of human capital (K) differences through occupational skill requirements (S) and unionization (U), as well as its direct effect on rate of pay (Y).[9] Second, each sector (or race) decomposition was done two ways. The first used the coefficients from the regression for the second sector (or blacks) as the standard. The second used the coefficients for the first sector (or whites) as the standard.

Results: Sector Difference in Pay

The means for all the variables in our model for each combination of race and sector are shown in Table 1. These results reveal some sector differences in human capital factors; however, given the emphasis that is sometimes placed on sector differences in the composition of the workforce (e.g., Beck, Horan, and Tolbert, 1978; Hodson, 1978), the means of most of the human capital type factors are quite similar in the competitive and monopoly sectors. In particular, the mean levels of education are almost identical in these two sectors, at least for whites. Although

Table 1 Variables Means by Sector and Race for Older Men

| Variables | Sector | | | | | |
|---|---|---|---|---|---|---|
| | Competitive | | Monopoly | | Public | |
| | Whites | Blacks | Whites | Blacks | Whites | Blacks |
| Dependent Variable | | | | | | |
| LNPAY | 1.65 | 1.14 | 1.85 | 1.50 | 1.78 | 1.52 |
| Human Capital and Residence Factors | | | | | | |
| YR | 71.2 | 71.1 | 71.1 | 71.2 | 71.3 | 71.3 |
| ED | 10.5 | 6.68 | 10.5 | 7.48 | 11.4 | 8.74 |
| EXP | 38.6 | 42.5 | 37.6 | 41.1 | 36.3 | 38.9 |
| MILT | 1.42 | .744 | 1.50 | .777 | 2.34 | 1.63 |
| HLTH | .206 | .235 | .189 | .148 | .205 | .196 |
| SMSA | .723 | .647 | .794 | .824 | .690 | .766 |
| SIZELF | .909 | .683 | .828 | 1.08 | .721 | 1.04 |
| SOUTH | .265 | .710 | .178 | .445 | .343 | .609 |
| FAOCC | 30.4 | 16.2 | 28.4 | 15.2 | 29.2 | 15.3 |
| FARM | .302 | .595 | .254 | .463 | .317 | .377 |
| Job Skill Requirements | | | | | | |
| GED | 11.3 | 8.99 | 11.3 | 8.90 | 11.9 | 9.88 |
| SVP | 2.17 | .938 | 2.45 | 1.01 | 2.31 | 1.33 |
| Unionization | | | | | | |
| % UNION | .230 | .250 | .507 | .569 | .294 | .288 |
| CBIND | .076 | .048 | .308 | .398 | .022 | .016 |
| CBOFT | .118 | .121 | .103 | .096 | .024 | .040 |
| CBOTH | .053 | .092 | .090 | .167 | .241 | .279 |

this is at variance with the results of Beck, Horan, and Tolbert (1978), it is in general agreement with the results of Hodson (1978), whose sector classification scheme I used.[10] These results suggest that the differences in the composition of the sectors in terms of individual characteristics may be less important than sector differences in how individual characteristics are translated into economic rewards. The results from the regression of log hourly earnings on the explanatory variables for each combination of race and sector are shown in Table 2. I will refer to selected aspects of the results in Tables 1 and 2 in the discussion of the decomposition of sector pay differentials shown in Table 3. The first row of both panels in this table shows the difference in the mean level of log hourly earnings in the two sectors identified at the top of the column. Since these entries, and all of the other entries in the Table represent differences in log dollars, they approximate a proportional difference.[11] The second row represents the human capital composition component, that is, that portion of the total difference that is due to sector differences in the mean level of human capital and location of residence factors. The portion of the total difference not accounted for by human capital composition is presented in the row labelled "sector premium." This entry approximates the proportionate difference in pay in the two sectors for men with the same measured human capital characteristics. The bottom rows in each panel show the decomposition of this sector premium into three components; occupational skill requirements composition, union composition, and a residual.

Table 2

Determinants of Log Hourly Earnings for Older Men, by Sector and Race

| | Sector | | | | | |
|---|---|---|---|---|---|---|
| | Competitive | | Monopoly | | Public | |
| Explanatory Variables | Reg. Coeff. | Stand. (Beta) Coeff. | Reg. Coeff. | Stand. (Beta) Coeff. | Reg. Coeff. | Stand. (Beta) Coeff. |
| Human Capital & Residence Factors | | | A. WHITES | | | |
| YR | .00585 | .03 | .00896 | .05 | .00439 | .02 |
| ED | .0351 | .21 | .0333 | .24 | .0292 | .23 |
| EXP | -.00556 | -.07 | -.00525 | -.08 | -.00994 | -.17 |
| MILT | -.153 | -.07 | -.0130 | -.08 | .00181 | .02 |
| HLTH | -.143 | -.11 | -.0534 | -.05 | -.0908 | -.08 |
| SMSA | .158 | .14 | .0804 | .08 | .0874 | .08 |
| SIZELF | .0216 | .05 | .0200 | .05 | .0754 | .17 |
| SOUTH | -.0789 | -.07 | -.0315 | -.03 | -.0356 | -.04 |
| FAOCC | .00197 | .09 | .000681 | .03 | .000612 | .03 |
| FARM | -.0564 | -.05 | -.0751 | -.08 | .0194 | .02 |
| CONST | .205 | | .318 | | .887 | |
| Job Skill Requirements | | | | | | |
| GED | .0551 | .25 | .0514 | .30 | .0262 | .16 |
| SVP | .0191 | .07 | .0209 | .08 | .0521 | .21 |
| Unionization | | | | | | |
| % UNION | .256 | .09 | .0961 | .05 | .181 | .07 |
| CBIND | .168 | .09 | .0250 | .03 | .0479 | .01 |
| CBCFT | .245 | .15 | .0590 | .04 | .0635 | .02 |
| CBOTH | .138 | .06 | -.00528 | .00 | .0410 | .04 |
| $R^2$ (ADJ) | .39 | | .39 | | .47 | |
| S.E.E. | .403 | | .334 | | .349 | |
| N | 1402 | | 1972 | | 996 | |

Table 2 (continued)

| Explanatory Variables | Sector: Competitive Reg. Coeff. | Competitive Stand. (Beta) Coeff. | Monopoly Reg. Coeff. | Monopoly Stand. (Beta) Coeff. | Public Reg. Coeff. | Public Stand. (Beta) Coeff. |
|---|---|---|---|---|---|---|
| Human Capital & Residence Factors | | | B. BLACKS | | | |
| YR | .0178 | .11 | .0102 | .08 | .00598 | .04 |
| ED | .00656 | .05 | .00489 | .05 | .0229 | .20 |
| EXP | -.0106 | -.15 | -.00792 | -.13 | -.00358 | -.06 |
| MILT | .00534 | .02 | -.00838 | -.03 | .00210 | .02 |
| HLTH | -.0281 | -.03 | -.0241 | -.02 | -.00607 | -.01 |
| SMSA | .160 | .17 | .151 | .17 | .213 | .20 |
| SIZELF | .0625 | .15 | .0137 | .05 | .0626 | .17 |
| SOUTH | .0264 | .03 | -.102 | -.15 | -.0664 | -.07 |
| FAOCC | .000792 | .02 | .00192 | .06 | .00251 | .06 |
| FARM | .0323 | .04 | -.0356 | -.05 | -.00369 | -.04 |
| CONST | -.212 | | .570 | | .348 | |
| Job Skill Requirements | | | | | | |
| GED | .00731 | .03 | .00482 | .03 | .0377 | .25 |
| SVP | .0523 | .14 | .0585 | .19 | .0180 | .06 |
| Unionization | | | | | | |
| % UNION | .338 | .15 | .294 | .18 | .119 | .05 |
| CBIND | .210 | .10 | .212 | .30 | .181 | .05 |
| CBCFT | .487 | .36 | .136 | .12 | .190 | .08 |
| CBOTH | .309 | .20 | .163 | .18 | .0958 | .10 |
| $R^2$ (ADJ) | .45 | | .41 | | .55 | |
| S.E.E. | .329 | | .267 | | .302 | |
| N | 587 | | 669 | | 499 | |

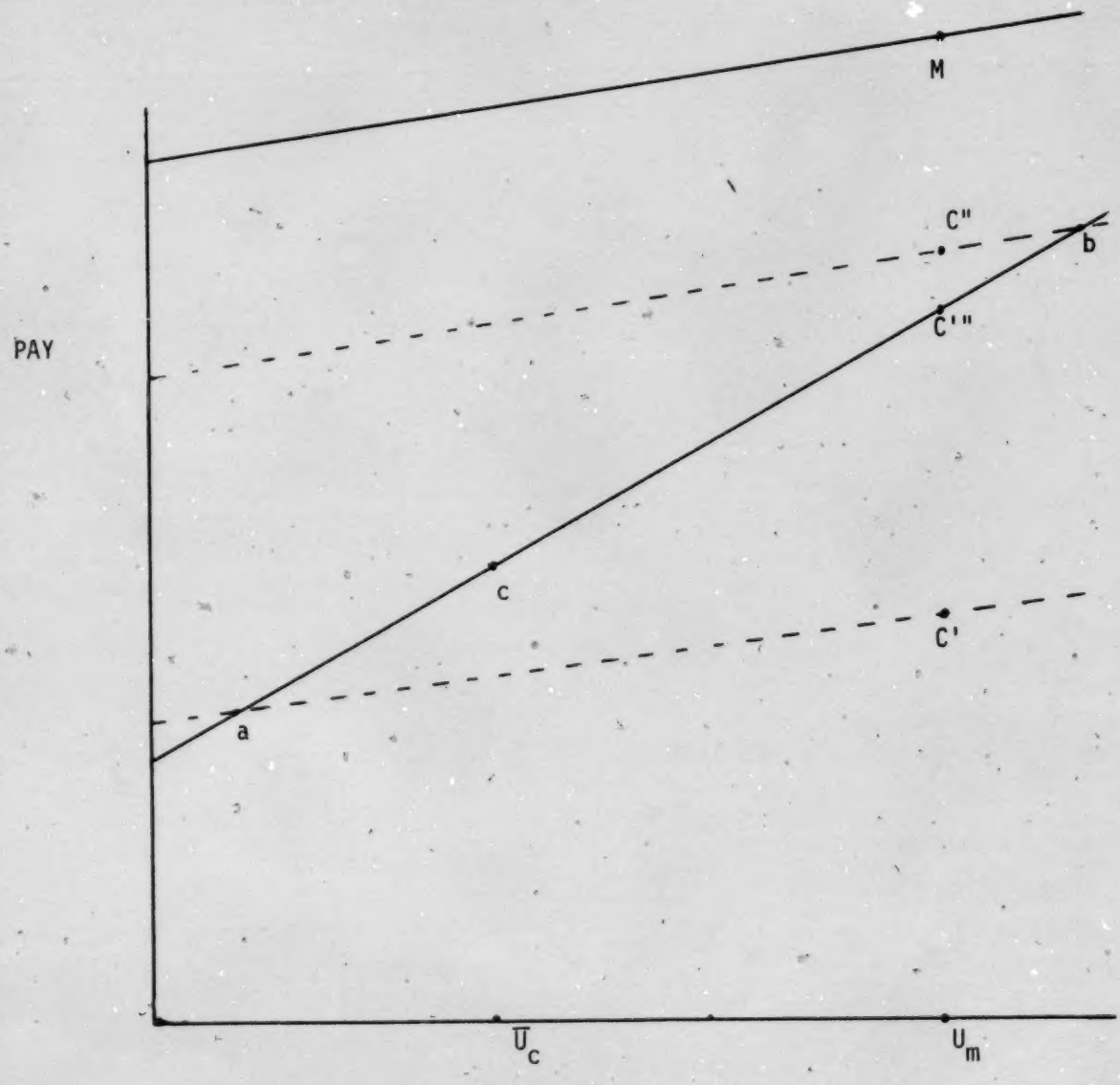
and background factors such as education and father's occupation are mediated by occupational skill requirements.[13] Thus, earnings appear to be more tightly linked to jobs in the monopoly sector; and, moreover, a well delineated job structure appears to play a more important role in the process by which white men obtain labor market rewards. This suggests that a job competition model, as opposed to a wage competition model (Thurow, 1975), may be more relevant to the monopoly sector than the competitive sector.

Unionization. Not surprisingly, we find substantial differences in the extent of and returns to unionization in the monopoly and competitive sectors. First, although there are small sector differences in the extent of craft and "other" types of unionization, the extent of industrial type unionization is much greater in the monopoly sector (Table 1). Second, the economic returns to each type of unionization measured at the individual level as well as the return to unionization measured at the industry level are all substantially greater in the competitive sector. The lower payoff to unionization measured at the individual level in the monopoly sector may be, in part, a reflection of greater "wage patterning" in that sector. Ross (1957) notes that there is variation across industries in the degree to which there is uniformity in wage rates across firms. He further argues that wage rates will be more uniform in those industries that are characterized by capital intensity, large firms, product market concentration, and high degrees of unionization (or in the terminology of dual economy theory, in the monopoly sector). Thus, the lower effects of the union variables measured at the individual level in the monopoly sector

supports Ross's argument. The lower effect for the union variable measured at the industry level in the monopoly sector could reflect either of two very different realities. On the one hand, it could indicate that unions are not an important determinant of rates of pay in the monopoly sector. However, I suspect that it is more likely to be a reflection of a substantial degree of "across industry" wage patterning in the monopoly sector.

To understand better the role of unionization in sector pay differentials it may be worthwhile to consider the question of what would occur to the monopoly sector premium if the degree of unionization (especially industrial) in the competitive sector was increased so that it became equal to that in the monopoly sector. To do this let us first examine the general nature of the relationship between unionization and pay for whites in the two sectors (Figure 2). The two solid lines in this Figure illustrate the expected level of pay for different levels of unionization (controlling for other variables). The different slopes correspond to the fact that the payoff to unionization is higher in the competitive sector than the monopoly sector. The mean levels of unionization in the two sectors are identified as $\bar{U}_c$ and $\bar{U}_m$. The mean levels of pay in the two sectors are identified by the points C and M, and the vertical distance between these points represents monopoly sector premium controlling for all variables except unionization. The issue then is what will happen to the monopoly sector premium if $\bar{U}_c$ moves to the right to correspond to $\bar{U}_m$. Of course the answer depends upon the nature of any movement in the line representing the expected level of pay in the competitive sector. From

Figure 2 Illustration of the Effect of Unionization on the Monopoly Sector Pay Premium



an analytical point of view we might identify three possible cases. The first two cases assume that as the level of unionization approaches that in the monopoly sector, then the returns to unionization will be reduced approaching those in the monopoly sector.

The first case assumes that the reduced returns to unionization are produced by a combination of no change in pay for nonunionized workers and lower pay for the average unionized worker in the competitive sector. This change can be represented in Figure 2 by rotating the expected pay line for the competitive sector about point "a," somewhere to the left of $U_c$ to correspond to a nonunionized worker, until it becomes (the lower dotted line) parallel to the expected pay line for the monopoly sector. If this were to happen the new mean pay level in the competitive sector would be at point C'. In this case, raising the level of unionization in the competitive sector would produce little change in, or possibly even increase, the monopoly sector premium.[14]

The second case also assumes that the returns to unionization in the competitive sector are reduced to those in the monopoly sector. However, this reduction is now presumed to occur because of an increase in pay for nonunionized competitive sector workers. This is a reasonable assumption if we believe that the "wage patterning" suspected of being important in the monopoly sector will become important in the competitive sector as it becomes more unionized. This change can be represented in Figure 1 by again rotating the expected pay line for the competitive sector, this time about a point "b" which corresponds to a unionized worker. In this case the average pay in the competitive sector would be increased to point C'', thus substantially reducing the monopoly sector premium.

The third case assumes that wage patterning will not be able to operate in the competitive sector the way it does in the monopoly sector. That is, because of the many differences between the sectors (e.g., economies of scale, product market power, political power) that help produce lower profits in the competitive sector, many nonunionized firms in this sector will simply not be able to pay union pay rates. This may occur if the sector differences in returns to unionization are due to basic differences in the social organization of production in the two sectors rather than to differences in the degree of unionization in the two sectors. In this case the average pay in the competitive sector would simply move along the expected pay line for the competitive sector to point C'''. Under these assumptions the monopoly sector premium would be reduced by .10 (the union composition component using the coefficients from the competitive sector as the standard). It is fairly safe to say that none of these three cases describes reality precisely. Since newly unionized workers would probably be working for firms less able than already unionized firms to pay high wages, the pay premium gained by these workers becoming organized would be likely to be less than the premium enjoyed by workers already unionized in the competitive sector. However, the average pay of workers who remain nonunion would probably increase somewhat due to wage patterning. Thus, a reasonable estimate of the contribution of unionization to sector differences in pay for whites would probably be somewhere between .03 and .10; that is, the union composition components calculated using the coefficients from the monopoly and competitive sectors, respectively.

This leaves a residual component of between .07 and .15 that is unexplained by sector differences in unionization and occupational skill requirements. This suggests that a substantial part of the sector premium is a result of monopoly sector firms possessing (1) a greater ability to pay high wages due to their greater economies of scale, market power, and political power, coupled with (2) a greater willingness to pay high wages due to a greater interest in developing a stable workforce. Note that this interpretation poses the important question of to what degree is this greater ability to pay high wages due to greater efficiency resulting from scale economies, or due to a greater ability to exploit the public through product market power and political power. Beliefs about the relative importance of these two factors are often intense; however, they appear to be more a function of political ideology rather than scientific evidence. Unfortunately, such evidence may remain elusive given the difficulty in obtaining valid indicators of the concepts of scale economies, market power, and political power independent of each other across a broad range of industries.

It is interesting to observe that the average pay for older white men in the public sector is greater than in the competitive sector and somewhat lower than in the monopoly sector. Controlling for human capital factors, the pay of public employees is about 9 percent higher than their counterparts in the competitive sector but is about 10 percent lower than workers in the monopoly sector. Thus these results do not support the belief held by some that public employees are overpaid.

Relative black disadvantages. Turning our attention to racial differences in pay, we see that they are largest in the competitive sector and smallest in the public sector (Table 4) In each sector, a substantial amount of this difference remains after controlling for human capital and location of residence factors, indicating that blacks are at a substantial pay disadvantage relative to whites in each sector. Also in each sector, the relative black disadvantage is greater when the black coefficients are used as a standard than when the white coefficients are used. Of course, this is due to the fact that, as has been found in many other studies, the returns to most human capital factors, in particular education, are greater for whites than for blacks. One way to interpret this is that the disadvantage, relative to whites, of blacks with the characteristics of a typical black are substantial, but the relative disadvantages of blacks with the characteristics of a typical white are even larger.

Regardless of which coefficients are used as a standard, the relative black disadvantages are greatest in the competitive sector and smallest in the public sector. Thus, our results concerning the disadvantages of blacks in the monopoly and competitive sectors contrast sharply with those of several other investigators (Becker, 1971; Shepherd, 1970; Haessel and Palmer, 1978; Beck, Horan, and Tolbert, 1978b; D'Amico, 1978) who found greater disadvantages for blacks in monopolistic industries. Our results are more consistent with those of Kaufman and Daymont (1978) and Johnson (1979) who found that the level of black disadvantages were about the same or somewhat lower in monopolistic industries.[15]

Table 4 Decomposition of Racial Differences in Pay and Relative Black Disadvantage by Sector for Older Men[a]

| Component | Sector | | | | | |
|---|---|---|---|---|---|---|
| | Competitive | | Monopoly | | Public | |
| | Black Coeff. | White Coeff. | Black Coeff. | White Coeff. | Black Coeff. | White Coeff. |
| Total Racial Difference | .51 | .51 | .35 | .35 | .26 | .26 |
| (minus) Human Capital Component | .13 | .31 | .14 | .21 | .13 | .15 |
| (equals) Relative Black Disadvantage | .38 | .20 | .21 | .14 | .13 | .11 |
| Job Skill Req. Component | .06 | .08 | .08 | .07 | .05 | .04 |
| Unionization Component | -.04 | .00 | -.08 | .00 | .00 | .00 |
| Residual Black Disadvantage | .36 | .12 | .21 | .07 | .08 | .07 |

[a]Each decomposition was calculated in two ways. The first used the coefficients from the regression for blacks as the standard. The second used the coefficients for whites as the standard. See the text and Appendix A for more information.

Besides experiencing pay disadvantages within sectors, it is also possible that blacks are disadvantaged by being channelled into the competitive, or lowest paying sector. Indeed, the proportion of blacks is somewhat higher in the competitive sector than in the monopoly sector. However, the results of an ancillary analysis suggest that this is a result of racial differences in individual characteristics. That is, when the human capital and location of residence factors are controlled, blacks were no more likely to be allocated to the competitive sector than to the monopoly sector.[16] Blacks were, however, more likely to be allocated to the public sector than to either of the private sectors.

Earlier, we identified several theoretical hypotheses that have been used to explain the various empirical findings concerning sector differences, or similarities, in black disadvantages. Our results are more consistent with some of these hypotheses more than others. For example, our results do not support the neoclassical hypothesis that (1) because discrimination is inefficient, competition will force discriminating firms to stop discriminating or eventually they will be driven out of business, and (2) that due to their market power, monopolistic firms are immune to such competitive pressures. It appears that any inefficiencies produced by discriminating against blacks are not nearly as important as other factors in determining the success and viability of firms, since many discriminating firms have survived in competitive industries. These results are consistent with the hypothesis that because of their size and market power, and their resulting visibility to the public and antidiscrimination agencies of the government, monopoly sector firms may be more wary of discriminating than firms in the competitive sector.

These results also support the hypothesis that the greater levels of bureaucratization in the monopoly sector lead to lower levels of black disadvantages in that sector than in the competitive sector. One of the key distinctions between bureaucratic and nonbureaucratic organizations is the greater use in the former of formal and nonarbitrary decision rules. Thus, bureaucratic officials are constrained in the degree to which they are able to incorporate subjective judgments and personal preferences when making decisions, including employment decisions (Selznick, 1969). Consequently, one might suspect that particularistic criteria such as race would be less important than universalistic criteria in the employment processes of large bureaucratic firms in the monopoly sector.

As noted above, this consideration of bureaucracy is closely related to the statistical discrimination argument. This argument holds that employers allocate blacks to less productive jobs because they underestimate the abilities of blacks and/or have less reliable information concerning their abilities (Thurow, 1975; Phelps, 1972; Doeringer and Piore, 1971). Thus, we would expect this phenomenon to be less important in those segments of the labor market where employment processes are characterized by objective criteria for evaluating the abilities of prospective workers, that is, the monopoly sector.

The relatively low levels of black disadvantages in the public sector lend further support to the hypotheses that bureaucratization leads to lower levels of racial discrimination. Of course, another factor contributing to this finding is that the government itself is one of the most important institutions in reducing discrimination.

This analysis has compared the level of black disadvantages across sectors. However, our results may also be relevant for trying to understand temporal changes in black disadvantages. As the volume of empirical evidence mounts, it is becoming increasingly clear that the level of black labor market disadvantages is declining (e.g., Freeman, 1973; Smith and Welch, 1977; Johnson and Sell, 1976; Farley, 1977; Daymont, 1979). However, there is much debate over the reasons for this change. Neoclassical economic theory of competitive markets leads directly to the conclusion that the pressures of competition is a basic force that will lead to lower levels of discrimination in the long run (e.g., Becker, 1971). Our results suggest that to the extent that there are basic forces embedded in our social system which will lead to less discrimination, they are not so much related to competitive market pressures, but to the processes of modernization and industrialization (Levy, 1966; Kerr et al., 1960). That is, as industrialization becomes more advanced, labor market relationships become more formal, more rationalized, and less personal, implying that particularistic criteria such as race become less important for labor market processes.

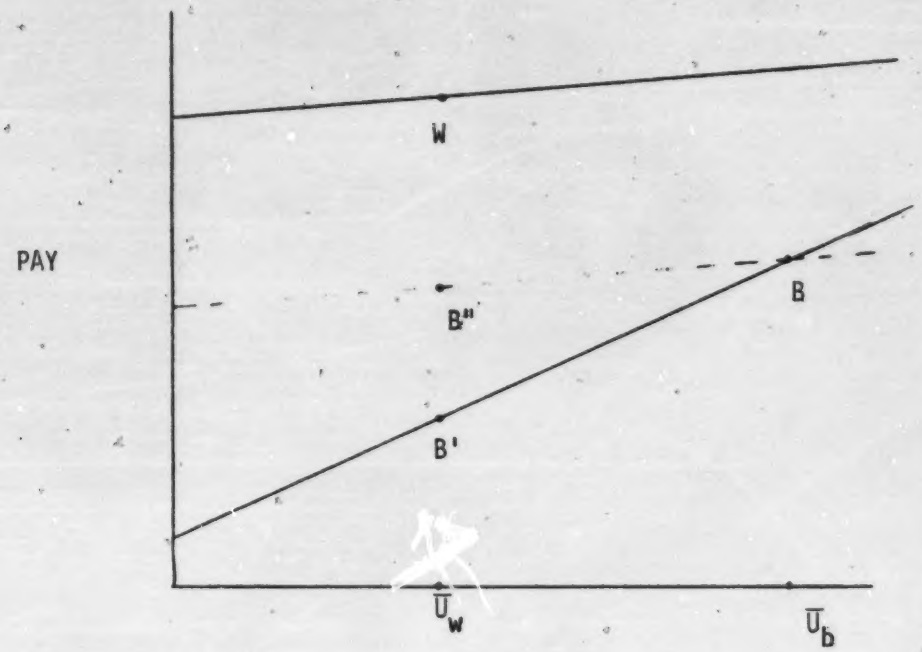
Whereas the differential allocation of men to jobs with different skill requirements did not explain much of the sector differences in pay, it did account for a significant portion of the relative black disadvantages within each sector. This portion varies somewhat by sector but averages about 35 to 40 percent of the total black disadvantage. This indicates that an important cause of the labor market disadvantage suffered by

blacks, relative to whites with similar characteristics, is that they are allocated jobs requiring less skill.

Despite the sector differences in other aspects of unionization, the pattern of racial differences in unionization are similar in the monopoly and competitive sectors (as shown in Tables 1 and 2 and as illustrated in Figure 3). First, the returns to unionization (as indicated by the slopes of the expected pay lines) are greater for blacks in both sectors. However, as the figure suggests, these greater "returns" to blacks might more accurately be thought of as a reflection of a greater penalty for not being organized rather than as a greater payoff to being unionized for blacks. Second, the level of unionization is somewhat greater for blacks ($\overline{U}_b$) than for whites ($\overline{U}_w$).

Thus, if we were to equalize the level of unionization by reducing $U_b$ and the black returns to unionization were to remain the same, the average level of pay for blacks in either of the private sectors would decrease from B to B'. If in the process of changing the black level of unionization to equal the white level, the returns for blacks become equal to the returns for whites, the average level of pay for blacks would change little (from B to B''). This suggests that the level of black disadvantages in these

Figure 3 Illustration of the Effect of Unionization on Black Labor Market Disadvantages



sectors would have been about the same or even greater had it not been for the effect of unions. Of course, this does not imply that unions have not discriminated--many have. However, it does suggest that the effects of such discrimination have been less costly to blacks than other aspects of labor market discrimination and/or, that such discrimination has been ameliorated by the effect that many unions have had in unifying particular workforces, thus lessening racial differences.

Summary and Conclusions

The most important findings of this analysis are:

(1) As has been found in previous studies, there is a substantial difference in pay among older men in the monopoly and competitive sectors. More importantly, after controlling for a number of human capital and location of residence factors, there exists a substantial pay premium for whites to monopoly sector employment of about 20 percent.

(2) Very little, if any, of this monopoly sector premium is due to sector differences in occupational skill requirements. However, a significant portion is accounted for by sector differences in the extent and type of unionization.

(3) A substantial portion of the monopoly sector premium is due to factors not explicitly included in the model. This suggests that part of this premium is a result of monopoly sector firms having (a) a greater

ability to pay high wages due to their greater economies of scale, market power, and political power, and (b) a greater willingness to pay high wages due to a greater interest in developing a stable workforce.

(4) The earnings determination process varies across sectors. In particular, well delineated job hierarchies play a more important role in the monopoly sector.

(5) Controlling for human capital and location of residence factors, public sector employers pay older men more than employers in the competitive sector but less than employers in the monopoly sector.

(6) In contrast to the results of several previous studies, the relative disadvantages of older black men are greater in the competitive sector than in the monopoly sector. This may be partially due to the greater degree of bureaucratization in the monopoly sector. The disadvantages of blacks are lowest in the public sector.

(7) In each sector, a significant portion of this disadvantage is due to the allocation of blacks, relative to whites with similar characteristics to jobs requiring less skill. In the competitive and monopoly sectors, the disadvantage of blacks might have been even greater had it not been for the effects of unions.

The results of this analysis provide strong support for the belief that labor market processes vary depending upon the organization of the process of production. Moreover, it appears that many of the ideas and concepts proposed in dual economy theory are useful for understanding this variation. However, more theoretical and empirical work needs to be done to identify the various mechanisms which produce observed sector differences in labor market processes. In particular, we need a better

understanding as to the way in which sector differences in outcomes and processes are due to economies of scale, market power, political power, bureaucracy, capital intensity, unionization, distribution of occupational skill requirements, and other factors.

## FOOTNOTES

[1]It should be noted that the concepts of duality and segmentation have been used in a number of different ways in the literature on dual economy theory, dual labor market theory, and labor market segmentation. One important distinction is whether sectors or segments are defined in terms of (1) the social organization of firms or industries, (2) characteristics of occupations, careers, or job rewards, or (3) a combination of both industrial and occupational characteristics. In this paper I define sectors, both conceptually and operationally, in terms of the social organization of industries, and then empirically examine how sectors so defined are different in terms of selected aspects of occupational distributions, labor market processes, and job rewards.

[2]Labor unions have also been cited as a reason for greater discrimination in the monopoly sector. In particular, Beck, Horan, and Tolbert (1978) assert that (1) since unions have operated in a way that works to the disadvantage of blacks, and (2) since unionization is more extensive in the monopoly sector, this should lead to greater discrimination in the monopoly sector. However, this argument fails to take account of the different types of union organization (Daymont, 1978). There is substantial variation across unions in the degree to which they control access to jobs and in the degree to which they discriminate against blacks (Northrup, 1944; Marshall, 1965; Ashenfelter, 1972). Although a detailed analysis of such union differences is beyond the scope of this study, it is useful to consider some differences between craft and industrial type unions. Craft or referral type unions control access to jobs in a more fundamental way than industrial type unions. Through the processes of the hiring hall, and by having some control over access to skills and credentials through appreticeship programs, craft unions exercise substantial control over both the size and composition of the labor pool for certain jobs; that is, they have a significant degree of monopoly power in the true sense of the word. Since they have historically been able to obtain and maintain such power without including blacks, they had little incentive to do so; and the pervasive racism in our society has provided ample incentive not to do so.

On the other hand, industrial unions have not been able to control the size and composition of the labor pool for specific jobs. Their limited control over access to jobs has been largely based on their ability to negotiate formal rules regarding job changes (e.g., seniority rules). Hence, compared to craft unions, industrial unions exercise a different and weaker kind of power. The power of industrial unions lies in acting as agents for collective bargaining, backed up by the threat of a strike. The success of such action depends upon the union representing (almost) all of the labor pool, both white and black.

Thus, it is not surprising that empirical investigations have generally found that while craft unionization has a negative effect on black-white wage ratios, industrial unionization appears to have had a positive impact (Ashenfelter, 1972; Leigh, 1978). This, in conjunction with the observation that most of the monopoly sector workers are members of industrial-type unions is inconsistent with a hypothesis that unionization is a factor in producing greater discrimination in the monopoly sector.

[3]On a conceptual level, this net association is viewed as being partly an effect of occupational skill requirements on unionization (e.g., the differential organization of workers in different occupations), partly an effect of unionization on occupational skill requirements (e.g., the influence of union rules and practices on hiring and promotion), and partly due to common causes not included in the model (e.g., an expected influence of economies of scale and capital intensity on both occupational skill requirements and unionization). To allow all of these effects would lead to an unidentified model. We could not arrive at a set of identifying assumptions that did not seem excessively arbitrary, and therefore we left this association unanalyzed.

[4]The variables included in K are: The year in which the interview took place (YR): the number of years of regular schooling completed (ED); the number of years of military experience (MILT); the number of years of civilian labor force experience (EXP) calculated as (Age-Ed-MILT-6) except that a respondent was not given credit for civilian labor force experience that occurred prior to the age of 12; the occupational status (measured by the Duncan SEI score) of the respondent's father (FAOCC); a dummy variable coded as 1 if the respondent resided on a farm at age 15 (FARM); a dummy variable coded as 1 if the respondent reported a health problem which limited his ability to work (HLTH); a dummy variable coded 1 if the respondent resided in the SOUTH; a dummy variable coded 1 if the respondent resided in an SMSA; and an indicator of the size of the local labor market for the respondent's area of residence (SIZELF).

[5]The conversion of GED and SVP to a years metric was done by Eckaus (1964).

[6]Type of union was based on a classification of the name of the union which was provided by the respondent. The "other" union category consisted of government employee and white collar unions and other miscellaneous and unclassifiable unions. A zero on all 3 variables indicates that the pay of the respondent was not covered by a collective bargaining agreement.

[7]Because of the unique nature of the labor market in the construction industry, workers in this industry were eliminated from the analysis. Agricultural workers were also eliminated because of the problems in getting an accurate assessment of their hourly earnings. Workers in two categories of nonprofit industries (welfare and religious services and nonprofit membership organizations) were also eliminated because of the extremely ambiguous position of these industries in relation to our sector distinctions. On the one hand, firms in these industries tend to be small, as are many competitive sector firms. However, these firms are not in competitive product markets in the normal sense of the term.

The only change I made in Hodson's scheme was due to the fact that I assigned individuals to the public sector according to the individual's class of worker code, whereas he assigned individuals to the state sector if they worked in an industry in which (1) most people worked for the government, or (2) most of the product was sold to the government. Thus, contrary to Hodson, non-government workers in 4 industries (ordnance manufaturing, electric light and power utilities, gas, steam and supply systems, and electric-gas utilities) were assigned to the monopoly sector instead of the state sector.

[8]These years were chosen because they were the only years in which all relevant information was asked. In addition to sample restrictions mentioned in the text, observations were eliminated if (a) they had hourly earnings (in 1976 dollars) of less than $.50, (b) were in the agricultural, construction, welfare and religious, or nonprofit membership organization industries, or (c) had missing data on any of the following variables: occupation, industry, class of worker, education, or age. For missing data on other variables, observations were assigned a mean or modal value.

[9]It is straightforward to calculate the direct and indirect effect subcomponents of human capital (see Appendix A). When this was done, it turned out that the indirect effect subcomponents were very small and unimportant, and therefore, they were not reported. The occupational skill requirements ($A^{SVP}$) component seems to be small because there is little in the way of sectoral differences in occupational skill requirements to be explained by human capital factors. The unionization subcomponent seems to be small because human capital factors do little in the way of explaining the sectoral differences in unionization.

[10]This paper does not examine the greater incidence of and payoff to "educational credentialism" in the monopoly sector that is indicated by the results of Beck, Horan, and Tolbert, and Hodson.

[11]This approximation holds well for values less than .10. As values become increasingly larger these differences under-represent proportional differences by increasing amounts.

[12]One must consider the possibility that the greater pay in the monopoly sector is simply compensation for lower levels of other job rewards. However, the results of a regression analysis indicated that net of the human capital and location of residence factors, the level of unemployment (as measured by the number of weeks unemployed during the past year) was slightly lower in the monopoly sector. Moreover, it is likely that the level of most fringe benefits is greater in the monopoly sector than in the competitive sector.

[13]This is based on a comparison of the reduced form effects (i.e., from equation 4) of education and father's occupation with the direct effects of these variables when GED and SVP are added to the equation for whites. In the competitive sector the effects of education and father's occupation are reduced by 35 and 29 percent, respectively. In the monopoly sector these reductions are 42 and 42 percent, respectively.

[14]The effect of raising the level of unionization in the competitive sector under these assumptions taken to their extreme (i.e., where point "a" corresponds to a value of 0 on each of the 4 unionization variables) is fairly easily quantified. It corresponds to the sum of a union composition component and a union rate component in our decomposition described in Appendix A. Equivalently, it corresponds to the sum of a union composition component, a union rate component, and a union interaction component in the type of decomposition outlined in Winsborough and Dickenson

(1969) and in Iams and Thornton (1975). In our model the sum of these components is -.06 implying that sector differences in unionization mitigate sector pay differentials, or alternatively, increasing the level of unionization in the competitive sector would increase the monopoly sector premium.

[15]In addition, preliminary analyses with the young men's sample of the National Longitudinal Surveys have yielded results very similar to those reported in this paper.

[16]A logit analysis was used to estimate a model expressing sector location (either competitive or monopoly sector) as a function of race and the human capital and location of residence factors. The coefficient for the race term was trivial and statistically insignificant.

## APPENDIX A

### Decomposition of Sector Pay Differences

This Appendix describes the decomposition of sector differences in mean log hourly earnings. In the section on analytical strategy in the text we identified three composition components and a residual. Actually, sector pay differences were decomposed into three composition components, two rate components, and a residual component (see below). The residual component could also be interpreted as a (human capital) rate component. However, since the rate components were seldom directly relevant to substantive issues, they were not presented separately in the text. The residual in the text is the sum of the two rate components and the residual component described in this Appendix.

In the first decomposition (i.e., the one presented in the left-hand column under each sector difference) I use the variable means for the first sector (denoted by a prime) and the coefficients for the second sector (denoted by the lack of a prime). The notation associated with equations 1-4 in the text is used. Thus, the sector difference $(\bar{Y}' - \bar{Y})$ can be partitioned into the following components:

(A) $\sum_i t_i [\bar{K}'_i - \bar{K}_i]$ — Human Capital Composition Component

(B) $\sum_j c_j [e'_j - e_j] + \sum_j \sum_i c_j [f'_{ji} - f_{ji}] \bar{K}'_i$ — Occupational Skill Requirements Composition Component

(C) $\sum_k d_k [g'_k - g_k] + \sum_k \sum_i d_k [h'_{ki} - h_{ki}] \bar{K}'_i$ — Union Composition Component

(D) $\sum_j [c'_j - c_j] \bar{S}'_j$ — Differential Payoff to Occupational Skill Requirements Component

| | | |
|---|---|---|
| (E) | $\sum_k [d'_k - d_k] \bar{U}'_k$ | Differential Payoff to Unionization Component |
| (F) | $[a' - a] + \sum_i [b'_i - b_i] \bar{K}'_i$ | (Residual) Sector Premium* |

*The residual in the text is the sum of components D, E, and F.

A couple of comments about this decomposition may be in order. First, interpreting the sum of D, E, and F as a residual sector premium is reasonable since it represents differences in the way that human capital and location of residence factors, occupational skill requirements, and unionization are rewarded in different sectors. Second, this decomposition is based on the block recursive model of equations 1-4, not a single equation. In particular, that part of sector pay differentials produced by differences in occupational skill requirement(S) or unionization (U) which was in turn produced by differences in human capital (K) was included in the human capital composition component. Third, in this decomposition, the "interaction components" (Winsborough and Dickenson, 1969; Iams and Thornton, 1975) are included in the rate (and residual) components. In the second decomposition (i.e., the one presented in the right hand column under each sector difference in Table 3), the interaction components are included in the composition components.

It may be useful to show that the components A through F actually sum to $(\bar{Y}' - \bar{Y})$. By substituting for S and U in equation 1 (in the text), it can be shown that,

$$t_i = b_i + \sum_j c_j f_{ji} + \sum_k d_k h_{ki}$$

Then substitute for $t_i$ in component (A) to obtain,

$$(A) = (A.1) + (A.2) + (A.3)$$

where,

$$(A.1) = \sum_i b_i [\bar{K}_i' - \bar{K}_i]$$

$$(A.2) = \sum_j \sum_i c_j f_{ji} [\bar{K}_i' - \bar{K}_i]$$

$$(A.3) = \sum_k \sum_i d_k h_{ki} [\bar{K}_i' - \bar{K}_i].$$

Here, A.1 represents the direct effect subcomponent of human capital, A.2 represents the indirect effect subcomponent of human capital through occupational skill requirements, and A.3 represents the indirect effect subcomponent of human capital through unionization. It is also useful to distinguish between the first and second terms in (B), (C), and (F). Noting that, for example,

$$(A.2) + (B.1) + (B.2)$$

$$= \sum_j \sum_i c_j f_{ji} [\bar{K}_i' - \bar{K}_i] + \sum_j c_j [e_j' - e_j] + \sum_j \sum_i c_j [f_{ji}' - f_{ji}] \bar{K}_i'$$

$$= \sum_j c_j [(e_j' - e_j) + \sum_i [f_{ji} (\bar{K}_i' - \bar{K}_i) + (f_{ji}' - f_{ji}) \bar{K}_i']]$$

$$= \sum_j c_j [(e_j' + \sum_i f_{ji}' \bar{K}_i') - (e_j + \sum_i f_{ji} \bar{K}_i)]$$

$$= \sum_j c_j (\bar{S}_j' - \bar{S}_j),$$

we can rearrange the terms of our decomposition as follows:

$$(F.1) + (A.1) + (F.2) + \left[(A.2) + (B.1) + (B.2)\right] + (D) + \left[(A.3) + (C.1) + (C.2)\right] + (E)$$

$$= (a' - a) + \sum_i b_i (\bar{K}_i' - \bar{K}_i) + \sum_i (b_i' - b_i) \bar{K}_i'$$

$$+ \sum_j c_j (\bar{S}_j' - \bar{S}_j) + \sum_j (c_j' - c_j) \bar{S}_j'$$

$$+ \sum_k d_k (\bar{U}_k' - \bar{U}_k) + \sum_k (d_k' - d_k) \bar{U}_k'$$

$$= (a' + \sum_i b_i' \bar{K}_i' + \sum_j c_j' \bar{S}_j' + \sum_k d_k' \bar{U}_k') -$$

$$(a + \sum_i b_i \bar{K}_i + \sum_j c_j \bar{S}_j + \sum_k d_k \bar{U}_k)$$

$$= \bar{Y}' - \bar{Y}$$

## APPENDIX B

### Sector Classification of Industries

| Industry Group | Sector |
|---|---|
| **Mining** | |
| Metal mining | MON |
| Coal mining | MON |
| Crude petroleum and natural gas | MON |
| Nonmetalic mining and quarrying | COMP |
| **Durable Manufacturing** | |
| Lumber and wood products | COMP |
| Furniture and Fixtures | COMP |
| Stone, clay, and glass products | MON |
| Metal industries | MON |
| Machinery, except electrical | MON |
| Electrical machinery, equipment, supplies | MON |
| Transportation equipment | MON |
| Professional and photographic equipment | MON |
| Ordance | MON |
| Miscellaneous durable manufacturing | MON |
| **Nondurable Manufacturing** | |
| Food and kindred products | MON |
| Tobacco manufacturers | MON |
| Textile mill products | COMP |
| Apparel and other fabricated textiles | COMP |
| Paper and allied products | MON |
| Printing, publishing and allied industries | COMP |
| Chemicals and allied products | MON |
| Petroleum and coal products | MON |
| Rubber and miscellaneous plastic products | MON |
| Leather and leather products | COMP |
| Not specified nondurable manufacturing | COMP |
| **Transportation** | |
| Railroads and railway express service | MON |
| Street railways and bus lines | COMP |
| Taxicab service | COMP |
| Trucking service | COMP |
| Warehousing and storage | COMP |
| Water transportation | COMP |
| Air transportation | MON |
| Petroleum and gasoline pipelines | COMP |
| Services incidental to transportation | COMP |

| Industry Group | Sector |
|---|---|
| Communications | |
| Radio broadcasting and television | COMP |
| Telephone (wire and radio) | MON |
| Telegraph (wire and radio) | MON |
| Utilities and sanitary services | |
| Electric light and power | MON |
| Gas, steam and supply systems | MON |
| Electric-gas utilities | MON |
| Water supply | COMP |
| Sanitation services | COMP |
| Other not specified utilities | COMP |
| Wholesale trade | COMP |
| Retail trade | COMP |
| Finance, insurance, and real estate | MON |
| Business and repair services | COMP |
| Personal services | COMP |
| Entertainment and recreation services | COMP |
| Professional and related services | COMP |

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## The Center for Human Resource Research

The Center for Human Resource Research is a policy-oriented research unit based in the College of Administrative Science of The Ohio State University. Established in 1965, the Center is concerned with a wide range of contemporary problems associated with human resource development, conservation and utilization. The personnel include approximately twenty senior staff members drawn from the disciplines of economics, education, health sciences, industrial relations, management science, psychology, public administration, social work and sociology. This multidisciplinary team is supported by approximately 50 graduate research associates, full-time research assistants, computer programmers and other personnel.

The Center has acquired pre-eminence in the fields of labor market research and manpower planning. The National Longitudinal Surveys of Labor Force Behavior have been the responsibility of the Center since 1965 under continuing support from the United States Department of Labor. Staff have been called upon for human resource planning assistance throughout the world with major studies conducted in Bolivia, Ecuador and Venezuela, and recently the National Science Foundation requested a review of the state of the art in human resource planning. Senior personnel are also engaged in several other areas of research including collective bargaining and labor relations, evaluation and monitoring of the operation of government employment and training programs and the projection of health education and facility needs.

The Center for Human Resource Research has received over one million dollars annually from government agencies and private foundations to support its research in recent years. Providing support have been the U.S. Departments of Labor, State, and Health, Education and Welfare; Ohio's Health and Education Departments and Bureau of Employment Services; the Ohio cities of Columbus and Springfield; the Ohio AFL-CIO; and the George Gund Foundation. The breadth of research interests may be seen by examining a few of the present projects.

The largest of the current projects is the National Longitudinal Surveys of Labor Force Behavior. This project involves repeated interviews over a fifteen year period with four groups of the United State population; older men, middle-aged women, and young men and women. The data are collected for 20,000 individuals by the U.S. Bureau of the Census, and the Center is responsible for data anlysis. To date dozens of research monographs and special reports have been prepared by the staff. Responsibilities also include the preparation and distribution of data tapes for public use. Beginning in 1979, an additional cohort of 12,000 young men and women between the ages of 14 and 21 will be studied on an annual basis for the following five years. Again the Center will provide analysis and public use tapes for this cohort.

The Quality of Working Life Project is another ongoing study operated in conjunction with the cities of Springfield and Columbus, in an attempt to improve both the productivity and the meaningfulness of work for public employees in these two municipalities. Center staff serve as third party advisors, as well as researchers, to explore new techniques for attaining management-worker cooperation.

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A third area of research in which the Center has been active is manpower planning both in the U.S. and in developing countries. A current project for the Ohio Advisory Council for Vocational Education seeks to identify and inventory the highly fragmented institutions and agencies responsible for supplying vocational and technical training in Ohio. These data will subsequently be integrated into a comprehensive model for forecasting the State's supply of vocational and technical skills.

Another focus of research is collective bargaining. In a project for the U.S. Department of Labor, staff members are evaluating several current experiments for "expedited grievance procedures," working with unions and management in a variety of industries. The procedural adequacies, safeguards for due process, cost and timing of the new procedure are being weighed against traditional arbitration techniques.

Senior staff also serve as consultants to many boards and commissions at the national and state level. Recent papers have been written for the Joint Economic Committee of Congress, The National Commission for Employment and Unemployment Statistics, The National Commission for Manpower Policy, The White House Conference on the Family, the Ohio Board of Regents, the Ohio Governor's Task Force on Health, and the Ohio Governor's Task Force on Welfare.

The Center maintains a working library of approximately 9,000 titles which includes a wide range of reference works and current periodicals. Also provided are computer facilities linked with those of the University and staffed by approximately a dozen computer programmers. They serve the needs of in-house researchers and users of the National Longitudinal Survey tapes.

For more information on specific Center activities or for a copy of the Publications List, write: Director, Center for Human Resource Research, Suite 585, 1375 Perry Street, Columbus, Ohio 43201.